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COMPLETE SPECIFICATION

NO DRAWINGS

Improvements relating to a Method of Making a Transparent Image

We, RANK XEROX LIMITED, a British Company, of 37/41 Mortimer Street, London, W.1, do hereby declare the invention for which we pray that a patent may be granted to us, and the method it is to be performed, to be particularly described in and by the following statement:—

This invention relates mainly to a method for forming an optical image.

The invention provides a method of forming an image on a porous, opaque layer comprising applying an imaging material in imagewise configuration which is of similar refractive index to the opaque layer and reducing the viscosity of said imaging material so that it flows into the pores to fill the pores of said opaque layer to render said opaque layer clear in said image areas.

The imaging material preferably consists of a substance such as a synthetic resin which has a low softening or melting point so that, although it may be solid at room temperature, n heating it becomes fluid enough to enter the porous spaces in the opaque layer. This action takes place in image areas upon heating so that the imaging material renders the layer clear in imagewise configuration. Solvent vapors may also be employed which will dissolve the imaging material but not the porous layer so that when an image is formed with this imaging material and subjected to solvent vapor, the imaging material dissolves and fills the pores of the porous layer in the same way that the heated imaging material does as described above. Other techniques for supplying solvent to the imaging material may also be employed.

Many different materials such as cellulose diacetate, cellulose triacetate, cellulose nitrtae, other cellulose esters and polymethylmethacrylate may be used to make the opaque porous layer. Such layers may easily be fabricated by dissolving any one of the aforementioned materials in a low boiling point solvent and coating it on a base plate in an atmosphere with high moisture content. This produces a phenomenon known as "blushing" and is caused because the rapid vaporization of the low boiling point solvent cools the coated layer by virtue of the latent heat of vaporization to such an extent that water vapor from the atmosphere condenses to the liquid phase in the surface layer of the dissolved resin so that when the solvent is fully evaporated off and the resin hardens, resin deficient spots are left in it in places which have been occupied by the condensed water droplets. The presence of such spots makes the layer more light-scattering than it would be if such spots were absent and the blushed layer is therefore opaque relative to an unblushed layer. The term "opaque" should be interpreted herein and in the appended claims in this sense rather than as meaning completely non-transmittent to light. Of course, when humidity of the atmosphere is too low and/or the vaporization speed of the solvent is not fast enough, this phenomenon will not occur. Blushing produces some severe effects on the mechanical properties of the layer. When blushing is too severe continuity of the layer is inadequate and it is frequently easy to peel a layer off its substrate as by rubbing. On the other hand, of course, when blushing is inadequate, the mechanical strength of the layer is very good but it is not porous enough to be opaque as required by this invention. It is generally desirable, therefore, that a compromise be selected so that the layer has adequate blushing so that it will diffuse light and have sufficient mechanical strength for general use.

In addition, other components such as extender pigments, or metallic soap waxes

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can be included in the coating layer for supplying required solubility in the coating solvent. Various other high molecular weight polymers may be employed as the coating and other techniques for obtaining porous opaque layers may also be used. For example, a gas-generating agent may be included in the coating material to form bubbles after coating commences. For the base supporting layer, colored opaque papers or transparent sheets may be used so that the layer will be suitable as a slide for optical projection or as a negative original for further imaging.

A number of different compositions and processes can be employed to make a patterned image. In one technique imaging materials which become fluid upon heating may be employed and these may initially be in the form of an emulsion, a solution or a solid. For example, a water emulsion of a wax having a low melting point may be used as an ink for writing on the coating. Then when the coating with the ink on its surface is heated to the melting point of the wax, the wax permeates through to the porous parts of the layer making the image appear clear. Of course, a solution of wax may also be used for writing on the same surface. The solvent used to make such a solution is one which does not change the structure of the opaque layer.

In another technique, when the image is applied as a solid material, the electrophotographic technique may be employed. That is to say, a wax having a low melting point or a metallic soap may be used as the developing powder and this patterned image may then be transferred or pressed onto an opaque porous layer followed by heating of this layer, produce the results described above. Other techniques than heating, also can be employed such as spraying of a solvent which increases the fluidity of the imaging material but does not change the construction of the opaque layer or placing of the material in a vapor of such a solvent so that the imaging particles will become liquid and fill pores in the layer. So as to apply pressure and heat at the same time, an electrophotographic paper which has a patterned image thereon and an opaque porous layer may be contacted together and put between heated rollers. Some examples of the technique are given below:

EXAMPLE I

A light scattering layer was fabricated which had the following composition—ethyl cellulose (refractive index 1.47), 10 parts by weight; acetone, 200 parts by weight; methanol, 200 parts by weight. This solution was coated on a polyester film base to a dry thickness of about 8 to 10 microns. When this coating was applied, the temperature was held at 25°C and the relative humidity immediately adjacent to the material was 60 per cent. These conditions produced a white or blushed surface on the coating. An image was then formed on the surface after it had cooled down wtih an ink made up of an emulsion of a wax (refractive index 1.45) with a melting point of 60°C dispersed in water. After formation of the image, the layer was heated to 70°C and dried and it was found that the wax had permeated into the porous parts of the layer and made image areas of the layer clear.

EXAMPLE II

A blush coating composed of 10 parts by weight of nitro cellulose (refractive index: 1.49); 2 parts by weight of silica gel powder (refractive index: 1.55); 70 parts by weight of acetone and 30 parts by weight of methanol was made up on a polyester film base to a dried thickness of 8 to 10 microns by coating the blend on the polyester base and drying it by blowing air held at 40°C and 55 per cent relative humidity over its surface. This produced a pure white blush surface coating. Images were formed on this coating according to the techniques described in Example I and good clear images were obtained.

EXAMPLE III

The patterned image was made according to the electro-photographic process with the image being composed of powdered cadmium stearate (refractive index 1.4-1.5) according to the following steps. An electrostatic charge of from about −400 to −450 volts was applied by corona discharge in the dark on a photoconductive insulating paper coated with particulate zinc oxide in a film-forming silicone resin binder, exposed to an image with light and developed with a developer consisting of 10 parts of powdered cadmium stearate and 500 parts of powdered iron. This powdered image was then transferred by a suitable xerographic method to a light scattering layer made up as described in the previous example and heated to 120°C for two minutes after transfer producing a clear image by the permeation of the stearate into the pores of the layer.

WHAT WE CLAIM IS:—

1. The method of forming an image on a porous, opaque layer comprising applying an imaging material in imagewise configuration which is of similar refractive index to the opaque layer and reducing the viscosity of said imaging material so that it flows into the pores to fill the pores of said opaque layer to render said opaque layer clear in said image areas.

2. A method according to claim 1 in which said imaging material is applied in powder form and the viscosity thereof is reduced by heating it.

3. A method according to claim 1 in which said imaging material is applied in

powder form and the viscosity thereof is reduced by subjecting it to the action of a solvent.

4. A method according to claim 1 in which said imaging material is a wax having a low melting point which is applied in the form of an emulsion and the viscosity of the wax is reduced by heating it.

5. A method according to any one of claims 1 to 3 comprising developing a latent electrostatic image on an electrophotographic plate with a powdered electroscopic developer made up of said imaging material to form a powder pattern representative of the latent electrostatic image, the material being applied in imagewise configuration by transferring the powder image to the opaque layer.

6. A method as claimed in any one of the preceding claims wherein said porous, opaque layer is a blushed layer.

7. A method of forming an image as claimed in claim 1 susbtantially as hereinbefore described.

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